1. A cylindrical gas container is closed at the top and open at the bottom. If the iron plate of the top is $\frac{5}{4}$ times as thick as the plate forming the cylindrical sides, the ratio of the radius to the height of the cylinder using minimum material for the same capacity is:

(A) $\frac{4}{1}$ (B) $\frac{1}{5}$ (C) $\frac{4}{5}$ (D) $\frac{20}{1}$

2. If $\begin{vmatrix} x^3+x & x+1 & x-2 \\ 2x^3+3x & 1 & 3x & 3x & 3 \\ x^3+2x+3 & 2x & 1 & 2x & 1 \end{vmatrix}$ = x A + B, then A = ____

(A) $\begin{vmatrix} 1 & 1 & 1 \\ 4 & 0 & 0 \\ 3 & 3 & 3 \end{vmatrix}$ (B) $\begin{vmatrix} 0 & 1 & 2 \\ 4 & 0 & 0 \\ 3 & 3 & 3 \end{vmatrix}$

(C) $\begin{vmatrix} 1 & 2 & 3 \\ 4 & 0 & 1 \\ 3 & 3 & 3 \end{vmatrix}$ (D) $\begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$

3. Which of the following is a root of the following equation ?

$$\begin{vmatrix} 0 & x & a & x & b \\ x+a & 0 & x & c \\ x+b & x+c & 0 \end{vmatrix} = 0$$

(A) a (B) b (C) 0 (D) 1

4. If $A = \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{bmatrix}$, then A^{100} is equal to:

(A) $\begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{bmatrix}^{100}$ (B) $\begin{bmatrix} 1 & 0 \\ 25 & 1 \end{bmatrix}$

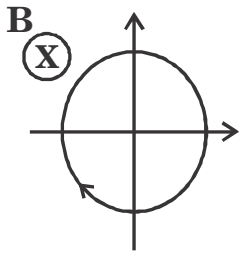
(C) $\begin{bmatrix} 1 & 0 \\ 50 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 0 \\ 100 & 1 \end{bmatrix}$

5. If $\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$, then find the value of

$$\begin{vmatrix} 2a_1 + 3b_1 + 4c_1 & b_1 & c_1 \\ 2a_2 + 3b_2 + 4c_2 & b_2 & c_2 \\ 2a_3 + 3b_3 + 4c_3 & b_3 & c_3 \end{vmatrix}$$

(A) Δ (B) 2Δ (C) $\frac{1}{2}\Delta$ (D) $(2\times3\times4)\Delta$

6. **A conducting loop, carrying a current I is placed in a uniform magnetic field pointing into the plane as shown. What tendency will the loop have ?**



(A) It contracts
(B) It expands
(C) It moves towards positive X-axis
(D) It moves towards negative X-axis

7. **Study the given information.**

> **When a rod of certain substance 'X' is suspended in a magnetic field, it quickly aligns itself along the direction of the magnetic field. Secondly, the substance 'X' moves from weaker part of the magnetic field to the stronger part.**

Based on the above information, what could substance 'X' be ?

(A) Aluminium (B) Gold
(C) Oxygen (D) Gadolinium

8. **A current of 20 A is maintained in a conductor of cross section 0.0001 m^2. If the number of free electrons is 9×10^{30} m^{-3}, calculate the drift velocity of free electrons. (Take e = 1.6×10^{-19}C.)**

(A) 0.138×10^{-6} m s^{-1} (B) 0.1125×10^{-6} m s^{-1}
(C) 0.35×10^{-6} m s^{-1} (D) 6.94×10^{-6} m s^{-1}

9. **The image obtained with a convex lens is erect and its length is four times the length of the object. If the focal length of the lens is 20 cm, calculate the object and image distance.**

(A) + 10 m, + 20 m (B) – 15 cm, – 60 cm

(C) – 10 m, + 40 m (D) + 12 cm, – 24 cm.

10. **Calculate the potential at the centre of a square PQRS of each side $\sqrt{2}$ m due to charges 2, –2, –3 and 6 μC at four corners of it.**

(A) 2.7×10^4 V (B) 3.8×10^6 V

(C) 4.5×10^7 V (D) 5.3×10^8 V

11. Identify how is the monomer used for the manufacture of PVC obtained.

(A) Addition of HCl to acetylene in the presence of Hg^{+2} salts

(B) Addition of HCl to ethylene in the presence of Hg^{+2} salts

(C) *Addition of* Cl_2 to acetylene

(D) Addition of Cl_2 to ethylene

12. Which of the following is the ideal condition for the manufacture of H_2SO_4 by contact process ?

(A) Low temperature, high pressure and high concentration of reactants.

(B) Low temperature, low concentration of reactants and low pressure.

(C) High temperature, high pressure and high concentration of reactants.

(D) Low temperature, low pressure and high concentration of reactants.

13. What is tempering ?

(A) The process of heating steel to bright red heat and then cooling it slowly.

(B) The process of heating the quenched steel to a temperature much below redness and cooling it slowly.

(C) The process of heating to bright red heat and then cooling suddenly by plunging it in oil or water.

(D) The process of giving a thin coating of hardened steel to a strong flexible, mild steel by heating in contact with charcoal and quenching in oil.

14. Why are amorphous solids considered to be super cooled liquids ?

(A) As they melt sharply at their melting points.

(B) As they exist in a solid state.

(C) As they soften on heating.

(D) As long range order is absent in them.

15. Study the given description of a complex ion.

- **It is an octahedral complex ion which is paramagnetic in nature**
- **It has an inner orbital complex ion**

Based on the given information identify the complex ion.

(A) $[Fe(H_2O)_6]^{3+}$ (B) $[FeF_6]^{3-}$

(C) $[CuCl_4]^{3-}$ (D) $[Fe(CN)_6]^{3-}$

16. Recognize the tool in the question and choose the most closely related tool or object from the given choices.

(A) 

(B) 

(C) 

(D) 

17. You are interviewd for a new job. Which of the following questions is most important to you ?

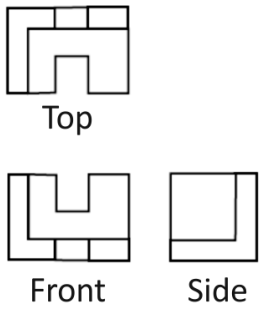
(A) Opportunities for promotions.

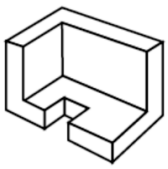
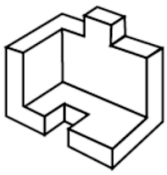
(B) Remuneration you will be paid.

(C) Scope to develop your ideas and use them to improve the working of the organisation.

(D) All the above are equally important.

18. **Identify the 3-dimensional object from the given three views.**



(A)  (B)  (C)  (D) 

19. **Recognize the tool in the question and choose the most closely related tool or object from the given choices.**

(A)  (B)  (C)  (D) 

20. **Three pencils cost the same as two erasers.**
Four erasers cost the same as one ruler.
Pencils are more expensive than rulers.
If the first two statements are true, the third statement is

(A) True (B) False
(C) Uncertain (D) None of these